呼吸防護具佩戴密合度測試方法比較

呼吸防護具佩戴密合度測試方法比較(1/2)

方法	定量測試		定性測試
	PortaCount	OHD	
優點	1. 不受測試人員主觀影響。 2. 測量時對粒子相當敏靈，且較不受粒子的大小、組成、形狀或特性所影響，故可適用目前任何產生之懸浮粒子，包括環境空氣中之粉塵。 3. 無密合係數限制。 4. 根據NIOSH以過濾氟氯烷氣體之研究，半面罩測試結果：PortaCount測試洩漏相關係數(0.79) > OHD (0.36)	1. 不受測試人員主觀影響。 2. 對氣態污染物之洩漏率，具有較佳之代表性。 3. 無採樣誤差，可模擬重度工作者之呼吸流量(100 l/min)。	1. 費用便宜。 2. 維護保養成本低。 
缺點	1. 費用高 2. 環境空氣顆粒濃度過低或過高會造成計數誤差。 3. 有採樣誤差，因測試微粒可能會被吸入人體或是測試者呼出之微粒被視為測試微粒而造成採樣誤差。 4. 微粒在儀器內管路的擴散損失。 5. 凝結區內蒸氣分子分布不均，造成部分微粒無法成長至可偵測大小。	1. 費用高 2. 檢測動作比portacount少，分析上少某幾個動作之洩漏數據。 3. 無法針對拋棄式口罩，如N95進行檢測。 4. 需要練習憋氣。 5. 無法動態性持續檢測，因為無法一直憋氣之故。 6. 不同人皮膚表面狀況，所測出壓力負壓值，無法代表實際微粒洩漏率。 7. 部分有呼氣閥設計之面罩可能允許小部分氣流向內洩漏，這種洩漏會導致錯誤的密合係數，易低估。	1. 個人主觀影響大。 2. 不精確。 3. 無結果報告。 4. 密合係數只能到100。 5. 不適合全面罩。

呼吸防護具佩戴密合度測試方法比較(2/2)

	測量時間	測量型態	失敗判定	採樣問題
定量測試(微粒) Condensation Nuclei Counter CNC	30秒	動態	綜合判定	潛在偏差(potential bias)
定量測試(負壓) Controlled Negative Pressure CNP	~8秒	靜態	綜合判定	無偏差(no bias)
定性測試(苦味劑) Bitrex	30秒	動態	即時(瞬間)判定	無偏差(no bias)

各種檢測法都有其優缺點及檢測限制，建議可針對不同之防護對象，例如是微粒或氣體，選擇合適之洩漏率檢測儀器，並選擇通過認證且可提供具證據力報告之單位進行檢測，如同身體健康檢查需要在通過TAF-15189之醫學檢驗單位進行檢查一樣。

主要參考文獻

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呼吸防護具佩戴密合度定量測試方法比較(1/3)

What NIOSH Did

The purpose of the study was to find out if any of the QNFT methods could predict actual human exposure to a gaseous hazard. **Test subjects were fit tested and also exposed to Freon gas.** The respirators were equipped with filter cartridges that prevent Freon from passing through, therefore **any Freon detected in the test subject's bloodstream had to be due to inhalation and respirator leakage.**

Comparison of the different fit test methods was done by calculating a correlation coefficient based on the **measured fit factors and measured Freon blood concentrations**. **A coefficient of 1.0 means that there is a perfect match. Coefficients above 0.8 are usually considered to be very good and those below 0.5 are considered poor.** It is also necessary to compare coefficients to each other rather than simply looking at the value by itself because experimental uncertainties can shift the values, yet leave their relationship to each other intact.

呼吸防護具佩戴密合度定量測試方法比較(2/3)

The NIOSH results for half mask respirators (Part II of NIOSH study)

The generated aerosol method (CHD) came out on top with a coefficient of 0.81. This confirmed it as the Gold Standard.

The PortaCount fit tester method (AA1) was a close second with a nearly identical coefficient of 0.78.

The CNP method yielded an unimpressive 0.36.

NIOSH Results for Half Mask Respirators (Part II)

QNFT Method	Correlation Coefficient (R^2)
Generated Aerosol (CHD)	0.81
PortaCount Fit Tester (AA1)	0.79
Controlled Negative Pressure (CNP)	0.36

呼吸防護具佩戴密合度定量測試方法比較(3/3)

What about Full-Face Respirators?

The poor results for the CNP method with half face respirators was corroborated in 2002 when NIOSH performed similar experiments using full-face respirators[3]. Those results cannot be directly compared to the half mask results because the coefficients were shifted due to some unknown reason. However, the relative differences between the coefficients confirm the sub-par performance of the CNP method discovered in Part II for half mask respirators. Relatively speaking, coefficients for the aerosol methods far exceeded the CNP coefficient. For full-face masks, the CHD and AA1 methods had coefficients of 0.09 and 0.11 respectively. The CNP coefficient was essentially zero (< 0.01).

NIOSH Results for Full Face Mask Respirators

QNFT Method	Correlation Coefficient (R^2)
Generated Aerosol (CHD)	0.09
PortaCount Fit Tester (AA1)	0.11
Controlled Negative Pressure (CNP)	0